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A preliminary study and new distributional records of family Erebidae (Leach, [1815]) (Lepidoptera: Noctuoidea) from Aligarh, Uttar Pradesh, India

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Abstract

In the present study, we have documented 59 species representing 43 genera of moths under family Erebidae (Leach, [1815]) from Aligarh district, the state of Uttar Pradesh, India. The documented species represents 10 subfamilies of family Erebidae viz., Aganainae (5 species), Arctiinae (10 species), Calpinae (5 species), Ctenuchinae (3 species), Erebinae (22 species), Eulepidotinae (1 species), Hypocalinae (2 species), Lymantriinae (8 species), Pangraptinae (1 species), and Scoliopteryginae (1 species). Out of these 59 species, Sixteen species *viz.* are *Asota plana* Walker, 1854; *Asota producta* (Butler, 1875); *Argina astrea* (Drury, 1773); *Olepa koslandana* Orhant, 1986; *Utetheisa pulchelloides* Hampson, 1907; *Eudocima homaena* (Hübner, [1823]); *Amata cysseus* (Stoll, [1782]); *Eressa confinis* (Walker, 1854); *Ophiusa tirhaca* (Cramer, 1777); *Pericyma cruegeri* (Butler, 1879; *Cyana puella* (Drury, 1773); *Lymantria mathura* Moore, [1866] and *Episparis liturata* (Fabricius, 1787) are recorded for the first time from Aligarh district, which also represents their first record from the present state of Uttar Pradesh.

Keywords: Aligarh; Erebidae; lepidoptera; moths; new distributional records; Uttar Pradesh

Abbreviations: AMU= Aligarh Muslim University; ZSI= Zoological Survey of India; GPRC= Gangetic Plain Regional Centre; AC = AMU Campus; AF = Outside of Aligarh fort; IG = Iglas; AT = Atrauli; KH = Khair; Km = kilometers; mi = mile; Mm = millimeters; in = inches; U.P. = Uttar Pradesh; * = First record from Uttar Pradesh

Introduction

It is a fact that the ecosystems are changing due to the interference of anthropogenic activities and we are losing our biodiversity at a high rate without even knowing their existence. Therefore, our highest priority should be to explore undiscovered species and to document the faunal and floral components from these small but bio-diverse rich pockets at regional as well as national levels. Moths contemplate have been advancing at a moderate pace in our nation, and lack of literature and expertise are the main reasons.

The territory of Uttar Pradesh is rich in huge Lepidoptera fauna is less concentrated up until now. Although, many studied have been taken up as far as butterflies are concerned but the moth's diversity remains understudied as compared to Himalayan ranges and the Western Ghats. However, moths play a very important role in urban landscapes as agricultural pests (Sharma, 2011; Sharma and Bisen, 2013), night pollinators (Devoto et al., 2011; Le Croy et al., 2013), and indicators of ecological health (Holloway, 1985). Family Erebidae (Lepidoptera: Noctuoidea) is the largest family of macro moths by species count 1,760 genera, 24,569 species (van Nieukerken et al., 2011) and contains a wide variety of well-known colorful and dull coloured moths and accountable for great economic losses and recurrent application of insecticide. There have been a number of studies in recent years examining moth diversity at different regions/states of India. It is not possible to discuss here all the studies from the Indian region but some of the important works are highlighted below. According to studies by Smetacek, (2008, 2009, 2011) at Kumaon Himalayas, Nainital, 81 species of Erebidae are present in that area. Northern Western Ghats of Maharashtra has been surveyed and known by 128 species of Erebidae (Subhalaxmi et al., 2011). Singh and Singh, (2012) reported new records of two species of Arctiidae (Erebidae: Arctiinae) from the Western Ghats. Further, Gurule and Nikam, (2013) reported 101 erebid species from northern Maharashtra. Sekhon and Singh, (2015) found 41 species of Erebidae moths from the Western Ghats. Singh et al. (2017) reported 40 species of the family Erebidae from Topchanchi Wildlife Sanctuary, Jharkhand. Paul et al. (2016, 2017) documented 27 species of Erebidae from Delhi. Sondhi and Sondhi (2016) compiled a checklist of 96 species of Erebidae from Uttarakhand. The only study from Sunderban Biosphere Reserve represents 14 species of Arctiinae (Biswas et al., 2016). Further, 117 species of Erebidae were recorded from Shendurney and Ponmudi in Agastyamalai Biosphere Reserve, Kerala (Sondhi et al., 2018); 54 species from Koderma, Jharkhand (Singh et al., 2018); 37 species from Vagamon hills, the Western Ghats, Kerala Mathew et al. (2018). Apart from the above, some other important studies on this family includes: five species of fruit piercing moth (Erebidae: Erebinae) was concentrated by Ramkumar et al. (2010) from the Himalaya region; Twenty four species of Tiger moths of the family Arctiidae (now Erebidae) have been recorded by Kirti and Sodhi (2003); 14 species of Erebidae recorded from Neora Valley National Park, West Bengal by Shah et al. (2017) and 10 species belonging to family Erebidae published by Kalawate and Sharma (2017). Two major documentation of these families includes 525 species under 140 genera of subfamily Arctiinae (Erebidae) from India was compiled by Singh et al. (2014). Another documentation of 917 species of Erebidae has been compiled by Sanyal et al. (2018) from Indian Himalayas. The most recent studies by Nayak and Ghosh (2020) reported 35 species of Erebidae from Banaras Hindu University, Varanasi. Still and all more study of moth fauna is awaited.

The present study was conducted in Aligarh district of Uttar Pradesh in India. It lies approximately 382 km (237 mi) northwest of Lucknow (State's capital) and around 130 Km (81 mi) southeast of the capital, New Delhi. Aligarh has a storm-affected sticky subtropical climate; the average summer temperature is 28-38 °C (82-100 °F). The monsoon season begins in late June, proceeding till early October, bringing high moistness. Aligarh gets a large portion of its yearly precipitation of 800 mm (31 in) during these months. Temperatures at that point lessening and winter sets in December, and proceeds till February. Temperatures go between 5-11 °C (41-52 °F). The habitat surrounding the surveyed site excessively covers agricultural crops, trees, and ornamental plants that nourish a lot of caterpillars of moths' species and this is the reason for good faunal habitat for moth adults to survive. But no such collective studies were carried out so far on the Lepidoptera of Aligarh in particular. An illustrated list of the species of Erebidae moths found during the study is presented below. This is the first attempt at documentation, as no earlier studies from Aligarh have been carried out. The results of the present study will surely act as a baseline for documentation of moths' fauna of Aligarh district as well as for Uttar Pradesh.

Materials and Methods

Study area

The study was conducted during February 2018 to March 2020, at Aligarh district of Uttar Pradesh (India). Five different sites viz. I. AC; II. AF; III. IG; IV. AT; and V. KH were selected on the basis of their habitat conditions (Figure 2) and GPS coordinates of each sites are listed in Table 1.



Figure 1. Maps of India and sampling sites of Aligarh district



Figure 2. Habitat surrounding the various study sites where sampling was conducted during the surveys. (Top left: AF, Top Right: AT, Bottom Left: IG, Bottom Right: Collections by Light trap)

Study sites	Habitat	GPS coordinates
Aligarh		
AC	Urban	27.9135° N 78.0782° E
AF	Grass land	27.9306° N, 78.0633° E
KH	Agricultural land	27.9392° N, 77.8424° E
AT	Forest	28.0305° N, 78.2858° E
IG	Grass land	27.7081° N, 77.9367° E
Over all coordinates		27.88°N 78.08°E

Table 1. Overview of survey sites

Moth surveys and identification

The selected sites were surveyed for two years and 26 nights were spent in the field with light traps at night to assess the moth species present in the region. The common and most convenient method of collecting moths were carried out by installing a light trap, having 160-watt mercury vapour lamp and a white cloth sheet $(3 \times 4 \text{ m})$, hung between two vertical poles in such a way that it touches the surface and extends forwards over the ground slightly away from the direct source of light. The source of the light ought to be put at such a point that the entire sheet from the edge toward edge brightly reflects the light which permits the greatest assortment of moths separately with no harm. The light trap was operated from evening to night time i.e. 18.00 to 01.00. Moths were started to show up on the snare soon after sunset and most of the moths gathered between 18.00 to 22.00 hours after that the bounty of moths were gradually declined. The collected specimens were killed with the ethyl acetate fumes and processed as per standard strategies in lepidopterology. Dry preservation is done in fumigated entomological boxes and stored in the insect cabinets at the Zoology Department of AMU as well as at the ZSI, GPRC, Patna.

The number of moths collected from different localities were identified with the available literature (Hampson, 1892; 1894; Kononenko and Pinratana, 2013; Singh *et al.*, 2014; Kirti and Singh, 2015; Singh *et al.*, 2019) as well as from literature mentioned in the introduction.

Results

During the study, 59 moth species were identified referable to 43 genera (Table 2, Plates 1-5). Three sub-families, Erebinae, Arctiinae, and Lymantriinae represent maximum populations (Table 3). Out of these 59 species, 16 species collected from Aligarh district have been encountered for the first time from the present state of Uttar Pradesh thus represents their range extension also. To confirm their range extensions, their previously known distribution in India is also provided below:

1. Asota plana Walker, 1854;

Distribution in Aligarh: IG.

Distribution in India: Bombay, Throughout South India (Hampson, 1892); Jharkhand (East Singhbhum), Assam, Orissa, Sikkim, Tamil Nadu (Sambath, 2014).

Elsewhere: Burma (Hampson, 1892); China, Myanmar, Singapore, Sri Lanka (Sambath, 2014).

2. Asota producta (Butler, 1875);

Distribution in Aligarh: AT.

Distribution in India: Assam, Sikhim, S. India (Hampson, 1892); Northern Maharashtra (Gurule, 2013); Kerala (Sondhi *et al.*, 2018).

Elsewhere: Ceylon (Sri Lanka), Burma, Penang, Sumatra (Hampson, 1892); Sri Lanka, Burma, Malaysia, Sumatra, Borneo (Gurule, 2013).

3. Argina astrea (Drury, 1773);

Distribution in Aligarh: AF. (Confirm record from Uttar Pradesh).

Distribution in India: Throughout India (Hampson, 1894); Andaman & Nicobar Island (Dubatolov, 2010).

Elsewhere: Mauritius, China, Africa, Ceylon (Sri Lanka), Burma and New Guinea (Hampson, 1894); Southern Iran, Pakistan, Bangladesh, Sri lanka, Nepal, China: Yunnan, Guangdong, Hong Kong, Zhejiang, Taiwan, Japan, Ryukyu, Philippines, Burma (Myanmar), Indochina, Indonesia, New Guinea, North Australia, New Caledonia, Oceania: Samoa, east to Palau, Guam, Taiti. Indian Ocean: Mauritius, East Africa (Dubatolov, 2010).

4. Olepa koslandana Orhant, 1986;

Distribution in Aligarh: IG.

Distribution in India: India (Singh and Singh, 2013). Karnataka (Bellary), Tamil Nadu (Coromandel Coast), Orrisa (Ganjam), Bihar, Jharkhand (Kirti and Singh, 2015).

Elsewhere: Sri Lanka (Singh and Singh, 2013).

5. Utetheisa pulchelloides Hampson, 1907;

Distribution in Aligarh: AC.

Distribution in India: Andaman & Nicobar Island (Kendrick, 2002); North India to Rajasthan, Sikkim, Assam, West Bengal, Tamil Nadu, Kerala, Orissa, Andaman & Nicobar Islands, Madhya Pradesh (Kirti and Singh, 2016).

Elsewhere: Indo-Australian and Pacific tropics, Australia, migrant to Vanuatu, New Caledonia, New Zealand, Hongkong (Kendrick, 2002).

6. Eudocima homaena (Hübner, [1823]);

Distribution in Aligarh: KH.

Distribution in India: Karnataka, Andhra Pradesh, Uttarakhand, Tamil Nadu, Rajasthan (Singh *et al.*, 2019).

Elsewhere: Sri Lanka, China, Myanmar, Malaysia, Indonesia, Singapore, Philippines, Oriental tropics, E. Palaearctic and Oriental regions from India and Sri Lanka also Sulawesi, Lombok, Flores, Timor (Singh *et al.*, 2019).

7. Amata cysseus (Stoll, [1782]);

Distribution in Aligarh: KH. Distribution in India: Himalayas, Uttarakhand (Shubhalaxmi *et al.*, 2011). Elsewhere: Sri Lanka (Shubhalaxmi *et al.*, 2011).

8. Eressa confinis (Walker, 1854);

Distribution in Aligarh: AC.

Distribution in India: Almora, Kulu (Hampson, 1892); West Bengal (Calcutta & Darjiling), Maharashtra (Bombay), N. W. Himalayas (Almorah & Kangra), Tamil Nadu (Nilgiris) (Sambath, 2014).

Elsewhere: Bhutan, Sri Lanka, Burma (Sambath, 2014).

9. Ophiusa tirhaca (Cramer, 1777);

Distribution in Aligarh: AF. (Confirm record from Uttar Pradesh).

Distribution in India: Throughout India (Hampson, 1894); India (Kendrick, 2002); Maharashtra (Shubhalaxmi *et al.*, 2011).

Elsewhere: Europe, S. Africa, Madagascar (Hampson, 1894); Europe, Africa, China, Japan, Philippines, Australia Hongkong (Kendrick, 2002); China, Japan, Philippines, Australia, S.E. Europe (Subhalaxmi *et al.*, 2011).

10. Pericyma cruegeri (Butler, 1886);

Distribution in Aligarh: AF.

Distribution in India: Northern Maharashtra (Gurule, 2013). Jharkhand (Singh and Ranjan, 2016)

Elsewhere: China, Indonesia (Sumatra, Borneo), Philippines, Australia Hongkong (Kendrick, 2002); Hong Kong, Taiwan, Vietnam, Thailand, Sumatra, Malaysia, Borneo, Philippines, New Guinea, Queensland (Gurule, 2013).

11. Anticarsia irrorate (Fabricius, 1781);

Distribution in Aligarh: IG.

Distribution in India: India (Kendrick, 2002); Nashik, Dhule (Northern Maharashtra) (Gurule, 2013). Elsewhere: Madagascar, China, Japan, Hong Kong (Kendrick, 2002).

12. Hypocala deflorata (Fabricius, 1794);

Distribution in Aligarh: AC.

Distribution in India: N.W. Himalayas, Nilgiris (Hampson, 1894); Tamil Nadu (Subhalaxmi et al., 2011); Jharkhand (East Singhbhum), Karnataka, Orissa, Sikkim (Sambath, 2014).

Elsewhere: E. and S. Africa (Hampson, 1894); Bangladesh, Myanmar, Thailand, Vietnam, Sri Lanka, Thailand, Nepal, Indonesia, China, Taiwan, Japan, Korea, New Zealand, Australia, South Africa, Madagascar (Subhalaxmi et al., 2011); Ethiopian region, Oriental of Sri Lanka (Sambath, 2014).

13. Hypocala violacea Butler, 1879;

Distribution in Aligarh: AC.

Distribution in India: India (Kendrick, 2002).

Elsewhere: Ceylon (Sri Lanka), Burma (Hampson, 1894); Sri Lanka, Nepal, Thailand, China, Japan, Singapore, Indonesia, New Guinea, Hong Kong (Kendrick, 2002).

14. Cyana puella (Drury, 1773);

Distribution in Aligarh: AT.

Distribution in India: Himachal Pradesh, Uttarakhand, Haryana, Sikkim, Meghalaya, Madhya Pradesh, Chattisgarh, Maharashtra, Tamil Nadu, Kerala, Andaman & Nicobar Islands, Gujarat, Bihar (Singh et al., 2020).

Elsewhere: Southeastern Pakistan, Nepal and China (Yunnan) (Singh et al., 2020).

15. Lymantria mathura Moore, [1866];

Distribution in Aligarh: KH.

Distribution in India: N.W. Himalayas, Sikkim (Hampson, 1892); West Bengal (DarjiJing) (Mandal and Maulik, 1997); NW. Himalaya, Sikkim, West Bengal (Kaleka, 2012).

Elsewhere: Nepal, China, Korea, Japan (Subhalaxmi et al., 2011); Taiwan, Thailand (Kaleka, 2012).

16. Episparis liturata (Fabricius, 1787)

Distribution in Aligarh: AF. (Confirm record from Uttar Pradesh).

Distribution in India: Punjab, North India, Kerala, Uttarakhand, West Bengal, Andamans (Kononenko and Pinratana, 2005; Shubhalaxmi et al., 2011).

Elsewhere: Sri Lanka, Myanmar, China, Thailand (Shubhalaxmi et al., 2011).

Tab	le 2. Summary of	Erebidae moths recorded during the	e study
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S. No.	Family	Sub-family	Name of species Author, Year
01.	Erebidae	Aganainae Boisduval, 1833	Asota caricae (Fabricius, 1775)
02.	Erebidae	Aganainae Boisduval, 1833	Asota ficus Fabricius, 1775
03*.	Erebidae	Aganainae Boisduval, 1833	<i>Asota plana</i> Walker, 1854
04*.	Erebidae	Aganainae Boisduval, 1833	Asota producta (Butler, 1875)
05.	Erebidae	Aganainae Boisduval, 1833	<i>Digama hearseyana similis</i> Moore, 1878
06.	Erebidae	Arctiinae Leach, [1815]	Aloa lactinea (Cramer, [1777])
07*.	Erebidae	Arctiinae Leach, [1815]	Argina astrea (Drury, 1773)
08.	Erebidae	Arctiinae Leach, [1815]	Creatonotos gangis (Linnaeus, 1763)
09.	Erebidae	Arctiinae Leach, [1815]	<i>Creatonotos transiens</i> (Walker, 1855)
10.	Erebidae	Arctiinae Leach, [1815]	<i>Olepa ricini</i> (Fabricius, 1775)
11*.	Erebidae	Arctiinae Leach, [1815]	<i>Olepa koslandana</i> Orhant, 1986
12.	Erebidae	Arctiinae Leach, [1815]	<i>Spilosoma obliqua</i> (Walker, 1855)
13.	Erebidae	Arctiinae Leach, [1815]	<i>Utetheisa lotrix</i> (Cramer, [1779])

14.	Erebidae	Arctiinae Leach, [1815]	<i>Utetheisa pulchella</i> (Linnaeus, 1758)
15*.	Erebidae	Arctiinae Leach, [1815]	Utetheisa pulchelloides Hampson, 1907
16.	Erebidae	<i>Calpinae</i> Boisduval, 1840	Culasta indecisa Moore, 1881
17*.	Erebidae	<i>Calpinae</i> Boisduval, 1840	Eudocima homaena (Hübner, [1823])
18.	Erebidae	<i>Calpinae</i> Boisduval, 1840	<i>Eudocima materna</i> Linnaeus, 1767
19.	Erebidae	<i>Calpinae</i> Boisduval, 1840	<i>Eudocima phalonia</i> (Linnaeus, 1763)
20.	Erebidae	<i>Calpinae</i> Boisduval, 1840	Oraesia emarginata (Fabricius, 1794)
21*.	Erebidae	Ctenuchinae Kirby, 1837	Amata cysseus (Stoll, [1782])
22*.	Erebidae	Ctenuchinae Kirby, 1837	<i>Eressa confinis</i> (Walker, 1854)
23.	Erebidae	Ctenuchinae Kirby, 1837	Syntomoides imaon (Cramer, [1779])
24.	Erebidae	<i>Erebinae</i> Leach, [1815]	Achaea janata (Linnaeus, 1758)
25.	Erebidae	Erebinae Leach, [1815]	Achaea serva (Fabricius, 1775)
26.	Erebidae	Erebinae Leach, [1815]	Artena dotata (Fabricius, 1794)
27.	Erebidae	Erebinae Leach, [1815]	Bastilla conficiens (Walker, 1858)
28.	Erebidae	Erebinae Leach, [1815]	Chalciope mygdon (Cramer, 1777)
29.	Erebidae	Erebinae Leach, [1815]	Chrysopera combinans (Walker, 1858)
30.	Erebidae	<i>Erebinae</i> Leach, [1815]	<i>Dysgonia torrida</i> (Guenée, 1852)
31.	Erebidae	Erebinae Leach, [1815]	<i>Entomogramma fautrix</i> Guenée, 1852
32.	Erebidae	Erebinae Leach, [1815]	Erebus macrops (Linnaeus, 1768)
33.	Erebidae	Erebinae Leach, [1815]	<i>Ercheia cyllaria</i> (Cramer, 1779)
34.	Erebidae	Erebinae Leach, [1815]	<i>Ercheia diversipennis</i> Walker, 1858
35.	Erebidae	Erebinae Leach, [1815]	Fodina stola Guenée, 1852
36.	Erebidae	Erebinae Leach, [1815]	Grammodes geometrica (Fabricius,1775)
37.	Erebidae	Erebinae Leach, [1815]	<i>Mocis frugalis</i> (Fabricius, 1775)
38.	Erebidae	Erebinae Leach, [1815]	<i>Mocis undata</i> (Fabricius, 1775)
39.	Erebidae	Erebinae Leach, [1815]	<i>Thyas coronata</i> (Fabricius, 1775)
40*.	Erebidae	Erebinae Leach, [1815]	<i>Ophiusa tirhaca</i> (Cramer, 1777)
41.	Erebidae	Erebinae Leach, [1815]	<i>Ophiusa triphaenoides</i> (Walker, 1858)
42.	Erebidae	Erebinae Leach, [1815]	Pandesma anysa Guenée, 1852
43 [*] .	Erebidae	Erebinae Leach, [1815]	Pericyma cruegeri (Butler, 1886)
44.	Erebidae	Erebinae Leach, [1815]	<i>Spirama retorta</i> (Clerck, 1764)
45.	Erebidae	Erebinae Leach, [1815]	<i>Trigonodes hyppasia</i> (Cramer, [1779])
46*.	Erebidae	<i>Eulepidotinae</i> Grote, 1895	<i>Anticarsia irrorata</i> (Fabricius, 1781)
47*.	Erebidae	<i>Hypocalinae</i> Guenée, 1852	<i>Hypocala deflorata</i> (Fabricius, 1794)
48*.	Erebidae	<i>Hypocalinae</i> Guenée, 1852	<i>Hypocala violacea</i> Butler, 1879
49 [*] .	Erebidae	Arctiinae Leach, [1815]	Cyana puella (Drury, 1873)
50.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Artaxa digramma</i> (Boisduval, 1844)
51.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Euproctis fraterna</i> (Moore, [1883])
52.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Euproctis lunata</i> Walker, 1855
53.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Euproctis similis</i> (Fuessly, 1775)
54.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Laelia exclamationis</i> (Kollar, 1848)
55.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Lymantria mathura</i> Moore, [1866]
56.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Olene mendosa</i> Hübner, 1823
57.	Erebidae	<i>Lymantriinae</i> Hampson, 1893	<i>Orvasca subnotata</i> Walker, 1865
58 [*] .	Erebidae	<i>Pangraptinae</i> Grote, 1882	<i>Episparis liturata</i> (Fabricius, 1787)
59.	Erebidae	<i>Scoliopteryginae</i> Herrich- Schäffer, [1852]	Anomis flava (Fabricius, 1775)

* - First record from Uttar Pradesh

S. No.	Subfamily	Number of genus	Number of species
1.	Aganainae	2	5
2.	Arctiinae	7	11
3.	Calpinae	3	5
4.	Ctenuchinae	3	3
5.	Erebinae	18	22
6.	Eulepidotinae	1	1
7.	Hypocalinae	1	2
8.	Lymantriinae	6	8
9.	Pangraptinae	1	1
10.	Scoliopteryginae	1	1
	Total	43	59

Table 3. Subfamily level breakdown for number of genus and species recorded during the survey



Plate 1. 1-Asota caricae; 2- Asota ficus; 3- Asota plana; 4- Asota producta; 5- Digama hearseyana similis; 6- Aloa lactinea; 7- Argina astrea; 8- Creatonotos gangis; 9- C. transiens; 10- Olepa ricini; 11- Olepa koslandana; 12- Spilosoma obliqua



Plate 2. 13- Utetheisa lotrix; 14- U. pulchella; 15- U. pulchelloides, 16- Culasta indecisa; 17- Eudocima homaena; 18- E. Materna Female, 19- E. phalonia; 20- Oraesia emarginata; 21- Amata cysseus, 22- Eressa confinis; 23- Syntomoides imaon; 24- Achaea janata



Plate 3. 25- A. serva; 26- Artena dotata; 27- Bastilla conficiens; 28- Chalciope mygdon; 29- Chrysopera combinans; 30- Dysgonia torrida; 31- Entomogramma fautrix; 32- Erebus macrops; 33- Ercheia cyllaria; 34- Ercheia diversipennis; 35- Fodina stola



Plate 4. 36- Grammodes geometrica; 37- Mocis frugalis; 38- M. undata; 39- Thyas coronata; 40- Ophiusa tirhaca; 41- O. triphaenoides, 42- Pandesma anysa; 43- Pericyma cruegeri; 44- Spirama retorta; 45- Trigonodes hyppasia; 46- Anticarsia irrorata; 47-Hypocala deflorata



Plate 5. 48- Hypocala violacea; 49- Cyana puella; 50- Artaxa digramma; 51- Euproctis fraterna; 52- E. lunata; 53- E. similis; 54- Laelia exclamationis; 55- Lymantria mathura; 56- Olene mendosa; 57- Orvasca subnotata; 58- Episparis liturata; 59- Anomis flava.

Discussion

After Hampsonian period, apart from some scattered publications on moths as already mentioned above no exhaustive data of moths from this state have been seen. The area of Aligarh is highly populated as well as associated with many agricultural practices. Both these factors, definitely alter the population of moths by anthropogenic activities as well as the chemicals being used in agricultural land. Whether, these activities are affecting the population of moths or not is unclear as no such data is available about these moth species. This is the first attempt by the authors to study moths from Aligarh (Uttar Pradesh) and will act as a baseline for comprehensive studies of the moths of this region. Although, the number of nights spent in field are less, yet the reporting of 16 new records extending their range in Aligarh district suggests that more efforts should be made in future with focus on moths to provide a detail account of moth species from Aligarh district, which can be used in planning the conservation strategies and management plans for the Aligarh district of Uttar Pradesh.

Conclusions

The current list of 59 Erebidae species including 16 new range extensions from Aligarh, Uttar Pradesh suggests more survey are needed in the area and hopefully many more species would be added. Not only this, surveys should be conducted in other parts of the state as well as in protected areas focusing on other families of moths. That will definitely enrich the moth fauna of the state.

Authors' Contributions

All authors read and approved the final manuscript.

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Conflict of Interests

The authors declare that there are no conflicts of interest related to this article.

References

- Biswas O, Modak BK, Mazumder A, Mitra B (2016). Moth (Lepidoptera: Heterocera) diversity of Sunderban Biosphere Reserve, India and their pest status to economically important plants. Journal of Entomology and Zoology Studies 4(2):13-19.
- Devoto M, Bailey S, Memmott J (2011). The night shift: nocturnal pollen-transport networks in a boreal pine forest. Ecological Entomology 36:25-35. *https://doi.org/10.1111/j.1365-2311.2010.01247.x*

- Dubatolov VV, de Ros R (2010). Tiger-moths of Eurasia (Lepidoptera: Arctiinae). Neue Entomologische Nachrichten 65:1-106.
- Arjun GS (2013). Taxonomic study of moths (Lepidoptera: Heterocera) from North Maharashtra (India). PhD thesis, The Univesity of Pune.
- Gurule S, Nikam S (2013). The moths (Lepidoptera: Heterocera) of northern Maharashtra: a preliminary checklist. Journal of Threatened Taxa 5(12):4693-4713. *https://doi.org/10.11609/JoTT.o2555.4693-713*
- Hampson GF (1892). The Fauna of British India, including Ceylon and Burma. Taylor and Francis (Volume 1), London, pp 527.
- Hampson GF (1894). The Fauna of British India, including Ceylon and Burma. Taylor and Francis (Volume 2), London, pp 609.
- Holloway JD (1985). Moths as indicator organisms for categorizing rain forest and monitoring changes and regenerating processes. In: Chadwick AC, Sutton SL (Eds), Tropical Rain-Forest, The Leeds Symposium, Special Publication, Leeds Philosophical and Literary Society pp 235-242.
- Kalawate A, Sharma RM (2017). Moths (Lepidoptera: Heterocera) from Pench National Park. Zoos' Print Journal 32(2):29-40.
- Kaleka APS (2012). Diversity of Tussock moths (Lepidoptera: Lymantriidae) on the Western Himalaya. Colemania 31:3-15.
- Kendrick RC (2002). Moths (Insecta: Lepidoptera) of Hong Kong. PhD thesis. The Univesity of Hong Kong.
- Kirti JS Sodhi JS (2003). Inventory of tiger moths of Sikkim (Arctiinae: Arctiidae: Lepidoptera). Zoos' Print Journal 18(7):1143-1146. https://doi.org/10.11609/JoTT.ZPJ.18.7.1143-6
- Kirti JS, Singh N (2015). Arctiid Moths of India. Nature Books New Delhi, India, (Volume 1) pp 205.
- Kirti JS, Singh N (2016). Arctiid Moths of India. Nature Books New Delhi, India, (Volume 2) pp 214.
- Kononenko VS, Pinratana A (2005). Moths of Thailand, Vol. 3, Part. 1. An illustrated Catalogue of the Noctuidae (Insecta, Lepidoptera) in Thailand. (Subfamilies Herminiinae, Rivulinae, Hypeninae, Catocalinae, Aganainae, Euteliinae, Stictopterinae, Plusiinae, Pantheinae, Acronictinae and Agaristinae). Brothers of St. Gabriel in Thailand. Bangkok pp 261.
- Kononenko VS, Pinratana A (2013). Moth of Thailand. Vol. 3, Part 2. Noctuoidea. An illustrated catalogue of Erebidae, Nolidae, Euteliidae and Noctuidae (Insecta, Lepidoptera) in Thailand. Brothers of St. Gabriel in Thailand, Bangkok.
- Le Croy KA, Shew HW, Van Zandt PA (2013). Pollen presence on nocturnal moths in the Ketona Dolomite glades of Bibb County, Alabama. Southern Lepidopterists' News 35:136-142.
- Mandal DK, Maulik DR (1997). Insecta: Lepidoptera: Heterocera, Sphingidae, Lasiocampidae, Lymantriidae & Ratardidae, Fauna of West Bengal. State Fauna Series: 3. Part 7, India, Zoological Survey of India, Calcutta, pp 613-687.
- Mathew P, Anand S, Sivasankaran K, Ignacimuthu S (2018). The moths (Lepidoptera: Heterocera) of Vagamon hills (Western Ghats), Idukki district, Kerala, India. International Journal of Entomology Research 3(2):114-120.
- Nayak A, Ghosh S (2020). Moth diversity (Lepidoptera: Heterocera) of Banaras Hindu University, Varanasi, India: a preliminary checklist. Notulae Scientia Biologicae 12(3):592-607. *https://doi.org/10.15835/nsb12310749*
- Paul M, Das SK, Singh R, Shashank PR (2016). Moth (Lepidoptera: Heterocera) Fauna of Delhi with notes on their role as potential agricultural pests. Journal of Entomology and Zoology Studies 4(2):435-438.
- Paul M, Das SK, Singh R, Pathania PC (2017). Study and updated checklist of moths (Lepidoptera: Heterocera) in selected areas of Delhi, India. International Journal of Current Research 9(08):56208-56214.
- Ramkumar J, Swamiappan M, Raguraman S, Sadasakthi A (2010). Species diversity and seasonal abundance of fruit piercing moth complex in Tamil Nadu. Journal of Biopesticides 3(1):11-15.
- Sambath S (2014). Taxonomic studies of Lepidoptera (Insecta) of Dalma Wildlife Sanctuary, Jharkhand (India). Records Zoological Survey of India, Occ. Paper No. 359.
- Sanyal AK, Mallick K, Khan S, Bandyopadhyay U, Mazumder A, Bhattacharyya K, ...Chandra K (2018). Insecta: Lepidoptera (Moths). In: Faunal Diversity of Indian Himalaya. Zoological Survey of India, Calcutta, pp 651-726.
- Sekhon CK, Singh J (2015). Inventory of owlet moths from Western Ghats of India (Noctuidae: Lepidoptera). International Journal of Applied Research 1(5):175-181.
- Shah SK, Mitra B, Das A, Mishra P (2017). A report on moth fauna (Insecta: Lepidoptera) in Neora Valley National Park, West Bengal, India. Journal of Environment and Sociobiology 14(2):179-186.

- Sharma AK, Bisen UK (2013). Taxonomic documentation of insect pest fauna of vegetable ecosystem collected in light trap. International Journal of Environmental Science: Development and Monitoring 4(3):1-8.
- Sharma G (2011). Studies on lepidopterous insects associated with vegetables in Aravali Range, Rajasthan, India. Biological Forum 3(1):21-26.
- Shubhalaxmi V, Kendrick RC, Vaidya A, Kalagi N, Bhagwat A (2011). Inventory of moth fauna (Lepidoptera: Heterocera) of the northern Western Ghats, Maharashtra, India. Journal of the Bombay Natural History Society 108(3):183-205.
- Singh N, Ranjan R (2016). Additions to the moth fauna of Dalma Wildlif Sanctuary, Jharkhand (India). Records Zoological Survey of India 116(4):323-336.
- Singh N, Singh J (2012). New records of two species of family Arctiidae (Lepidoptera) from Western Ghats of India. Records of Zoological Survey of India 112(1):25-26.
- Singh N, Singh J (2013). Review of the genus Olepa Watson (Lepidoptera: Erebidae: Arctiinae). Tinea 22(4):272-277.
- Singh J, Singh N, Joshi R (2014). A checklist of subfamily Arctiinae (Erebidae: Noctuoidea: Lepidoptera) from India. Records Zoological Survey of India 367:1-76.
- Singh N, Ahmad J, Joshi R (2017). An Inventory of Moths (Lepidoptera) from Topchanchi WLS, Jharkhand (India). Journal of Entomology and Zoology Studies 5(4):1456-1466.
- Singh N, Ahmad J, Joshi R (2018). Moths (Lepidoptera) diversity of district Koderma, Jharkhand. Journal of Entomology and Zoology Studies 6(2):1253-1263.
- Singh N, Ahmad J, Kaustubh K, Joshi R (2019). New distributional records of *Eudocima* Billberg, 1820 (Lepidoptera: Erebidae: Calpinae) from Gangetic Plains (India). Records Zoological Survey of India 119(3):238-245.
- Singh N, Volynkin AV, Kirti JS, Datta HS, Ivanova MS (2020). A review of the genus *Cyana* Walker, 1854 from India, with descriptions of five new species and three new subspecies (Lepidoptera: Erebidae: Arctiinae: Lithosiini). Zootaxa 4738:01-93.
- Smetacek P (2008). Moths recorded from different elevations in Nainital District, Kumaon Himalaya, India. Bionotes 10(1):5-15.
- Smetacek P (2009). Additions and corrections to the list of moths recorded from different elevations in Nainital District, Kumaon Himalaya, India. Bionotes 11(4):117-118.
- Smetacek P (2011). Further Additions to the Moths (Lepidoptera: Heterocera) of Nainital District, Kumaon Himalaya, India. Bionotes 13(4):140-141.
- Sondhi Y, Sondhi S (2016).vA partial checklist of moths (Lepidoptera) of Dehradun, Mussoorie and Devalsari in Garhwal, Uttarakhand, India. Journal of Threatened Taxa 8(5):8756-8776. https://doi.org/10.11609/jott.2814.8.5.8756-8776
- Sondhi Y, Sondhi S, Pathour SR, Kunte K (2018). Moth diversity (Lepidoptera: Heterocera) of Shendurney and Ponmudi in Agastyamalai Biosphere Reserve, Kerala, India, with notes on new records. Tropical Lepidoptera Research 28(2):66-89.
- van Nieukerken EJ, Kaila L, Kitching IJ, Kristensen NP, Lees DC, Minet J, ... Zwick A (2011). Order Lepidoptera. In: Zhang Z-Q (Ed). Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness. Zootaxa 3148:212-221. https://doi.org/10.11646/zootaxa.3148.1.41



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